xCoAx 2026
Torino, Italy
2026.xCoAx.org

Matrix Glitz: An Aesthetic of Entanglement

Jonas Bohatsch
jonas.bohatsch@uni-ak.ac.at
Coding Lab, University of Applied Arts
Vienna, Austria

Matrix Glitz is a light-based installation that intervenes at the optical surface of an algorithmically driven LED matrix. 3D-printed grids placed in front of LED panels produce visual behaviour that cannot be assigned to either side of the digital/analogue divide. Three optical phenomena emerge: moiré patterns from the interference of multiple periodic structures and chromatic gradients from the angular occlusion of subpixels—both responsive to the viewer's position—and luminosity at the cell edges that makes the computed image appear to hover above the panel surface. The phenomena arise through two distinct mechanisms: the interference of rule-governed periodic systems on the one hand, and the behaviour of light at material apertures on the other. They are themselves a mix of digital and analogue aesthetics. None of these effects are part of the programme driving the LEDs. Drawing on recent arguments that digital and analogue are constitutively entangled rather than opposed (Cramer 2014; Galloway 2022), the paper proposes physical intervention at the material boundary of an LED display as a method of artistic inquiry into computational media devices, and argues that something of that entanglement becomes aesthetically perceptible in the phenomenology of the work—sparkling and shimmering, at once discrete and continuous, focused and scattered.

Keywords: Hybrid Media, Media Materiality, Entanglement, Discreteness, LED Matrix, Optical Phenomena, Moiré, Iridescence.

DOI 10.34626/2026_xcoax_037

Introduction

The installation stems from an artistic research practice driven by an interest in computational media, algorithmic and generative art, digital aesthetics, and the creation of work that is both sensually and conceptually engaging. The work itself, however, began not with a theoretical question but with a material curiosity. In the process of deconstructing LED matrix panels to figure out how to modify their physical appearance, I at some point began designing 3D-printed grids and placing them in front of the panel surface. What appeared when the two structures interacted under light was striking: a shimmering, colour-shifting image that seemed to give the panel a different materiality, responsive to the body in the way a piece of fabric or brushed metal is. The investigation that followed, and that this paper documents, is an attempt to understand what that encounter consists of and what it might mean for thinking about the supposedly fixed properties of digital displays.

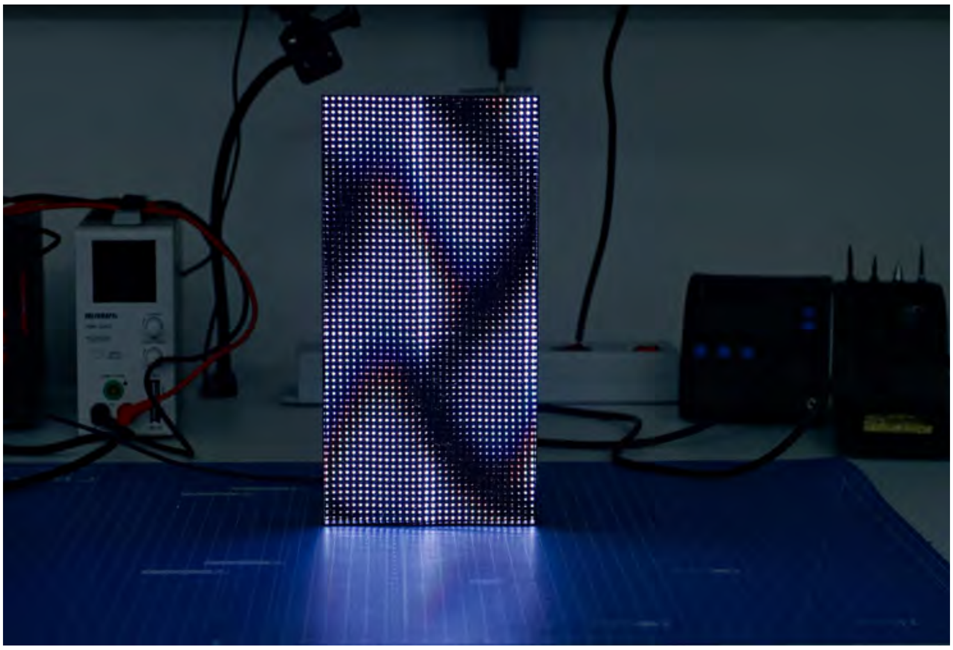


Fig. 1. Single *Matrix Glitz* module in operation with all LEDs set to pure white. The moiré pattern and gradients are visible in this image; luminous depth and shimmer cannot be fully captured by conventional imaging devices and are only visible when viewed in person.[1]

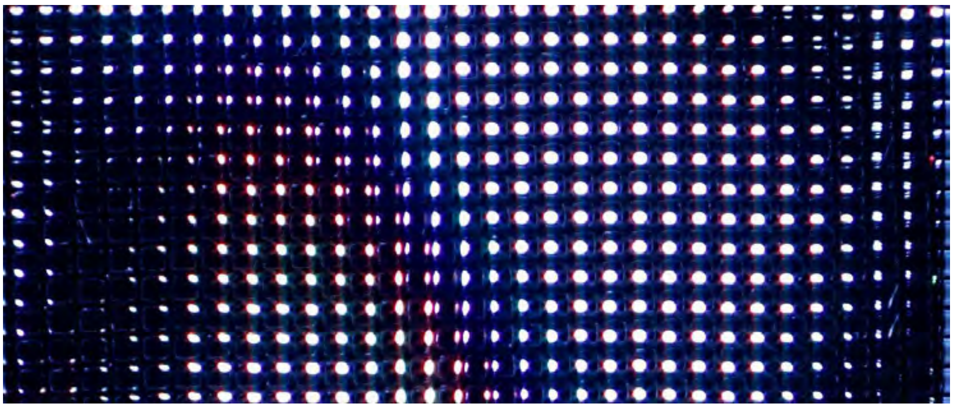


Fig. 2. Enlarged version of a part of the photo seen in Fig. 1. The colour and brightness shifts caused by partial occlusion of LED subpixels caused by the rotated superimposed grid are clearly visible.

—
1. All figures and the referenced video are by the artist.

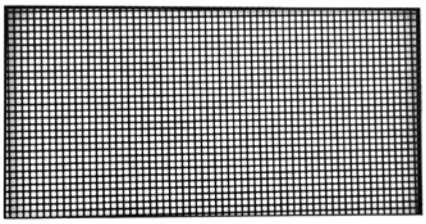


Fig. 3. Photo of a 3D-printed grid structure featuring a 1° rotated grid.

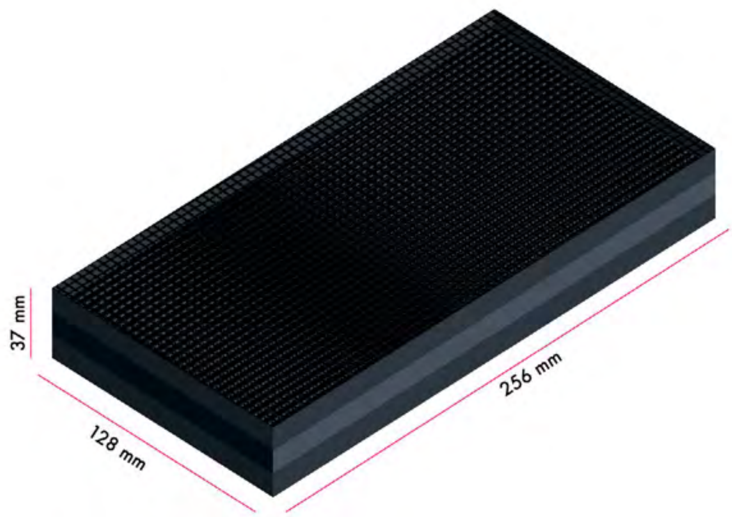
Technical Setup & Artistic Research

The installation consists of custom-generated 3D-printed grids placed at approximately one centimetre in front of LED matrix panels.[2] The superimposed grids are designed with a cell pitch close to but not identical to the LED pixel pitch, and their orientations are slightly rotated relative to the matrix. The grid lines themselves can also depart from straight geometry, modulated along sine or Perlin-noise curves, altering the cell geometry along the way.

The optical phenomena that emerge from the encounter between the LED matrix and superimposed grids—and especially the full perceptual configuration that unfolds across viewing positions and distances—were not analytically predictable from the geometric specifications of the two structures alone; they had to be encountered. The work therefore proceeded through structured iteration: across many cycles of design, printing, and observation, variations of grid structure were tested, modulating cell geometry, rotation, offset, and distance—judged subjectively by the perceptual finesse of the resulting effects. Each prototype constituted a small experiment in how those parameters modulate the resulting perceptual presence. To rapidly iterate over physical prototypes, a script using the CadQuery Python module (CadQuery 2023) was developed to generate 3D model files of these structures, which were then 3D-printed in PLA filament.

The generative noise animations displayed on the LED matrix were programmed on an Adafruit MatrixPortal S3 microcontroller (Adafruit 2023) using the Arduino framework and the Adafruit Protomatter library. The visual output is driven by a layered Perlin noise system developed prior to the present work and only slightly modified for the grid intervention. A custom web interface including a preset system was developed to allow real-time control of generative and colour parameters. A custom-designed and 3D-printed back panel houses the electronics; USB power keeps the system portable.

Fig. 4. Drawing of a complete module (without power supply) showing dimensions (128 x 256 x 37 mm).



—

2. The panels used specifically for this installation have an array of 32×64 pixels with a 4mm pixel pitch (P4). The setup is not specific to these dimensions; LED panels with other array sizes and pitches would require corresponding adjustments to the 3D-printed grid geometry.

Optical Phenomena

The superimposed grid introduces a second periodic structure into a system that already consists of regular arrays of discrete light-emitting elements: the LED matrix. The interaction between these periodic systems, together with the optical behaviour of the emitted light, produces a set of effects that are not part of the programme driving the LEDs but arise from the material and geometric conditions of the physical setup. Three phenomena have been observed—moiré patterns, chromatic gradients, and a luminous depth—together with parallax as the spatial mechanism by which the first two become responsive to bodily movement.

Moiré patterns are generated by the interference between the periodicity of the LED pixel grid and that of the superimposed structure. Because the periodic geometry of the 3D-printed grid is close to the LED pixel pitch but slightly offset, the two periodic structures beat against each other across the panel surface rather than aligning into invisibility or diverging into unrelated patterns. The relatively small rotation angle of 1° was deliberately chosen to produce only low-frequency moiré interference across the panel surface.

Chromatic gradients emerge from the same kind of interference that produces the larger moiré pattern, but operating at the subpixel scale. Each pixel of the LED matrix is itself composed of three discrete emitters—a red, a green, and a blue sub-LED—arranged in a small cluster within the pixel cell. These subpixels are physically separated emitters, fused into a single perceived colour only by the eye at viewing distance. The 3D-printed grid intervenes precisely at this micro-scale separation. Its cell walls selectively block red, green, and blue subpixels depending on the viewer's line of sight, producing smooth colour and brightness shifts that are entirely absent from the digital signal being sent to the LEDs. The result is a kind of iridescence—angle-dependent chromatic shifts familiar from oil films, beetle wings, or brushed metal—produced here not by thin-film interference but by the geometric interference between the printed grid and the three offset subpixel grids that constitute the LED matrix's colour structure.

At the edges of each grid cell, light from the LEDs scatters and spreads, producing a perceived luminous depth. The computed image appears to hover between the physical surface of the LED matrix and the surface of the superimposed grid, as if the light were occupying the volume between panel and grid rather than being emitted from a flat plane. This effect intensifies as the distance between grid and matrix increases and diminishes when the grid is placed closer to the panel surface, confirming that it is a function of the spatial gap and the optical behaviour of light at the aperture edges.

Finally, because the grid is held at a fixed distance from the LED panel, its periodicity is registered against the pixel grids through a stereoscopic offset that varies continuously with the viewer's position. Parallax is therefore not a separate effect added to the others, but the spatial mechanism by which moiré and chromatic gradients become responsive to bodily movement. Luminous depth, by contrast, depends on the spatial gap between grid and matrix rather than on viewer position.

Considered together, these phenomena constitute a single visual presence—shimmering, iridescent, volumetric, perceptually alive—that none of them taken alone would predict. All but the impression of depth could plausibly be simulated in software, but doing so would require tracking the viewer's position and computing subpixel occlusion in real time—a considerable technical overhead that would, moreover, only yield a correct result for a single observer at a time. The physical grid achieves the same range of effects without any electronic computation at all and for any viewer.

Fig. 5. Two modules set up next to each other on a white desktop table.

Entanglement & Emergence

Moiré and chromatic gradients arise from the interference of rule-governed periodic systems: between the LED matrix and the superimposed 3D-printed grid at the pixel scale, and between the printed grid and the three offset subpixel grids at a finer scale. The encounters between them produce effects that exceed what either structure exhibits in isolation.

Luminous depth arises differently. It is not the product of two periodic systems combining, but of light itself encountering a discrete material structure. Each grid cell selectively transmits, occludes, and scatters the light reaching it from multiple LEDs at multiple angles, and the contributions from neighbouring apertures overlap in the air gap. The resulting impression of depth belongs neither to the panel nor to the grid taken alone, but to the volume between them held open under illumination.

It is tempting to call the first set of effects digital and the second analogue, but the work shows these registers to operate together rather than in opposition. The LED panel is a hybrid digital–analogue system in Cramer's sense: its addressable pixel array is digital—a system of discrete countable units—while the light leaving each diode is analogue (Cramer 2014). The 3D-printed grid is symmetrical: digital as a logical structure of regularly spaced apertures defined by a parametric script, analogue as a physical body whose edges depart continuously from the idealised model. Galloway (2022) extends this on broader theoretical grounds, arguing that digitality and analogueicity are not opposing technological registers but general modes of mediation evident across many formats and historical periods. The digital and the analogue are not two pre-existing domains that the apparatus combines; they are co-constitutive aspects of a single material situation. The 3D-printed grid is therefore not a bridge between two domains. It is the element that makes their pre-existing entanglement productive: it engages both layers at once, passively, simply by being a geometrically specified material object placed in front of an electronically addressed surface.

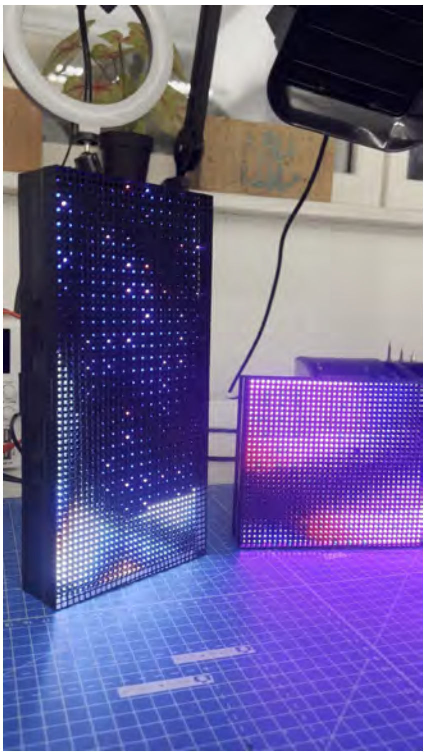


Fig. 6. Video showing two modules operating, https://vimeo.com/1165117916

The optical phenomena that arise from this encounter are themselves a mix of digital and analogue aesthetics. Moiré and chromatic gradients are aesthetic effects of discreteness—they exist because the LED matrix and the grid are made of periodic addressable structures. Luminous depth is an aesthetic effect of analogue optics—it exists because light scatters at material edges and accumulates in volumetric space. What the work offers is a perceptible instance of the digital and the analogue as constitutively entangled registers of a single apparatus, made visible at the small spatial gap where multiple discrete structures meet light and a viewing body.[3] The simultaneously discrete and continuous, focused and scattered appearance of *Matrix Glitz* is an aesthetic form of that entanglement.

Conclusion

Matrix Glitz proposes physical intervention at the optical surface of an electronic display as a method perceptual consequence: a shimmering, iridescent, volumetric, perceptually alive image that exceeds the visual capacities of either component alone and acquires what reads, phenomenologically, as its own materiality. The work does not pursue this excess by raising resolution, increasing computational power, or extending algorithmic complexity. It intervenes at the material boundary of the display, where the apparatus's discrete and continuous registers are already operating together. The shimmering, the depth, the chromatic shifts: none of them could be achieved through code alone. They belong to optics and to material as much as to the rule-governed periodicities they encounter, and they make legible an entanglement that the apparatus carries from the start. A viewer standing in front of

—

3. The structural figure that *Matrix Glitz* inherits—periodic geometries encountering one another under light, with the viewer's body as a co-condition of the image—was not first posed by computational media. A generation of postwar artists associated with kinetic and Op art—among them Joël Stein, Heinz Mack, Antonio Asis and Marc Adrian—built rule-governed objects whose perceptual effects emerged from the interaction of periodic geometries, light, and the viewer's movement, as documented in the 2016 reconstruction of the 1967 exhibition Kinetika in Vienna (Husslein-Arco et al. 2016).

the panel does not need to follow the argument to encounter what the argument is about. Discreteness becomes visible as moiré. The continuous behaviour of light becomes visible as luminous depth. The viewer's own movement becomes a parameter of the image. The work proposes that artistic intervention at the material surface of a computational device is one way—and perhaps a particularly direct one—to make the constitutive hybridity of such devices available to perception rather than only to argument. The work sparkles and shimmers—at once discrete and continuous, focused and scattered. In this, the analogue/digital entanglement of computational media might just have become aesthetically perceptible.

References

Adafruit.
2023. "Adafruit Matrix Portal S3 CircuitPython Powered Internet Display." Accessed April 30, 2026. www.adafruit.com/product/5778

CadQuery.
2023. "CadQuery: Python module for building parametric 3D CAD models" Accessed April 30, 2026. https://cadquery.readthedocs.io

Cramer, Florian.
2014. "What Is 'Post-Digital'?" *A Peer-Reviewed Journal About 3* (1 Post-digital Research): 10–24.

Galloway, Alexander R.
2022. "Golden Age of Analog." *Critical Inquiry* 48 (2): 211–32.

Husslein-Arco, Agnes, Harald Krejci, and Axel Köhne, eds.
2016. *Rück Blick: Kinetika 1967*. Belvedere.